



REBELLION
PHOTONICS

Honeywell

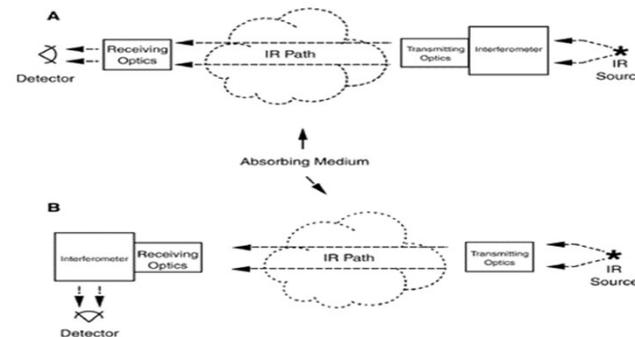
- Current Offerings for gas detection
- Rebellion Photonics – a Honeywell Company quick glance
- Gas Cloud Imaging System
 - Demo video
 - Camera offerings today
 - Gases available
 - How it detects?
 - Software video demos
 - Weather condition demo videos
 - Future Products of Rebellion Photonics

[Continuous Monitoring – The Status Quo]

Single Point Gas Sensors



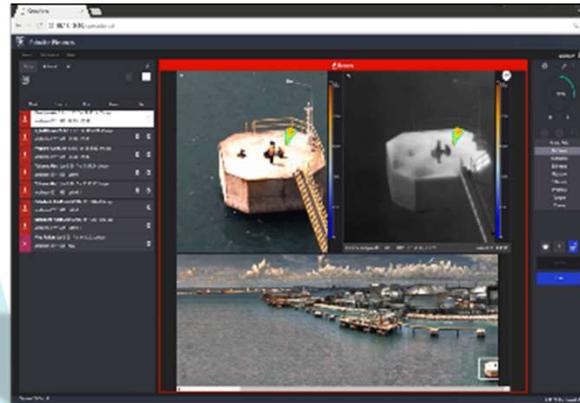
Open and Closed Path Line Detectors



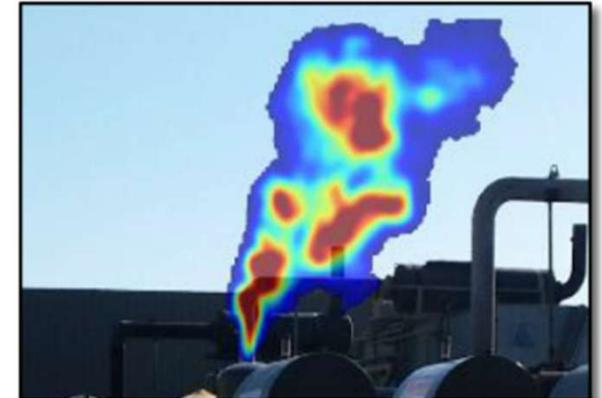
“Rebellion is a platform provider of intelligent visual monitoring systems that make sites safer, greener, and more profitable”



**UNIQUE HYPERSPECTRAL
VISUAL SENSORS**



**ALARM MANAGEMENT
SOFTWARE INTERFACE**



**PHYSICS ENHANCED AI REAL-TIME
LEARNING (PEARL) ANALYTICS**



GCI System

[Rebellion Photonics, a Honeywell Company]

NOW A HONEYWELL COMPANY
80+ Systems installed Globally



Validated by Government Agencies, Industry

and Institutions



WGC 2018 Innovation Awards

Rebellion Photonics, Methane (1.0km)





Standard GCI

Detection Out To 1700 Meters

Designed for large sites and extended areas

Communication Cable



Viz Camera

Hyperspectral
Imaging
Sensor
(Patented)

Pan/Tilt Unit

- Fix Mounted
- 7 Analytics per camera
- 360° Radius with +/-180° Pan & +/-45° Tilt
- **Long Range** or **Wide Field** options available

Mini GCI

Detection Out To 100 Meters

*Designed for congested areas
and small sites*

Communication Cable



Viz Camera

Hyperspectral
Imaging
Sensor
(Patented)

Pan/Tilt Unit

- Fix Mounted
- 7 Analytics per camera
- 360° Radius with +/-180° Pan & +/-45° Tilt
- Explosion-proof option available

[Intelligent, Automated, Visual Monitoring Solution]

- **Improves Safety**
 - Removes the need for employees to explore the hazardous gas plume with sniffers to quantify the leak
 - 24x7 Monitoring
- **Saves Time on maintenance**
 - Leaks immediately identified – no time wasted identifying the source
- **False Alarms vastly reduced**
 - No False alarms on steam
- **Saves on CAPEX**
 - Cables run to less areas/detectors
- **Saves OPEX**
 - Fully autonomous, round-the-clock automatic operation.
 - No humans needed to monitor the system
 - Self Calibrating



Gases**Established Gases**

Acetic Acid
Acetone
Ammonia
Benzene
1,3 - Butadiene
Carbon Dioxide^M
1,1 - Difluoroethane
Ethane
Ethylene
Ethylene Oxide
Iso-Butane
Iso-Butylene
Methane
Methanol
Natural Gas
N-Butane
N-Pentane
Propane
Propylene
Sulfur Hexafluoride
Toluene
Xylene

Custom & Mixtures

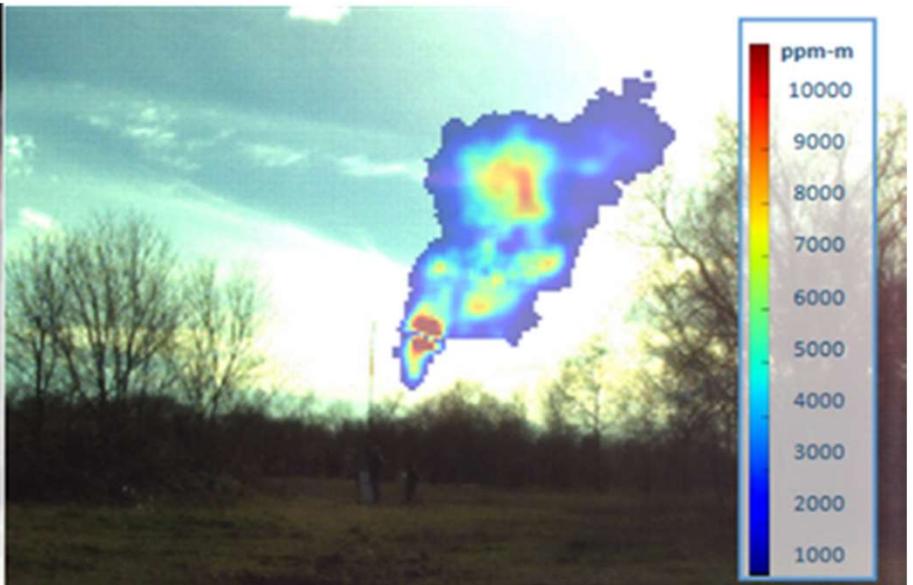
Diluent
Ethylene/Propane Mix
Ethane/Ethylene/Propane Mix
Gasoline
HVN
Jet Fuel
LCN
LPG
LVN
MoGas
Naphtha
TUF
Ultraformate
Unleaded Gasoline

Theoretical

Acrylonitrile
Boron TriFluoride
1,2 - Dichloroethane
Ethanol
Hydrogen Chloride
Hydrogen Sulfide
Iso-Pentane
Propylene Oxide
R410A
Sulfur Dioxide^M
Vinyl Chloride



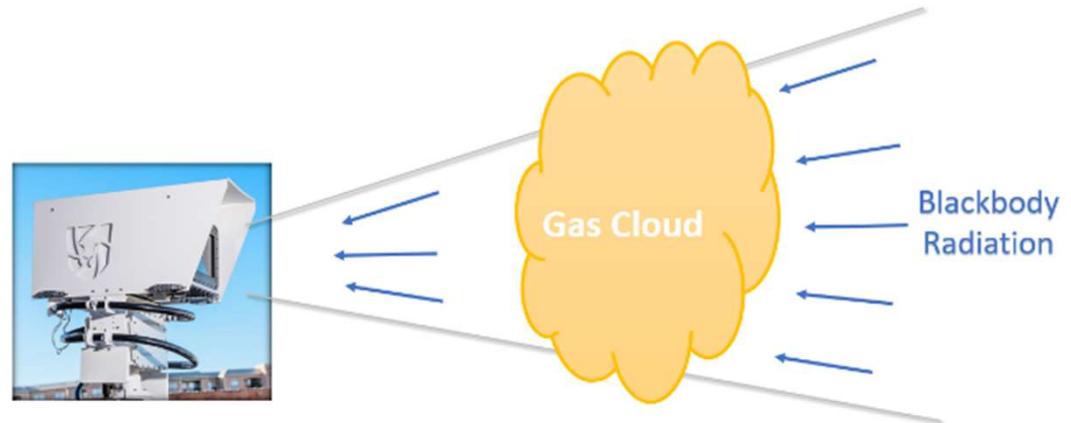
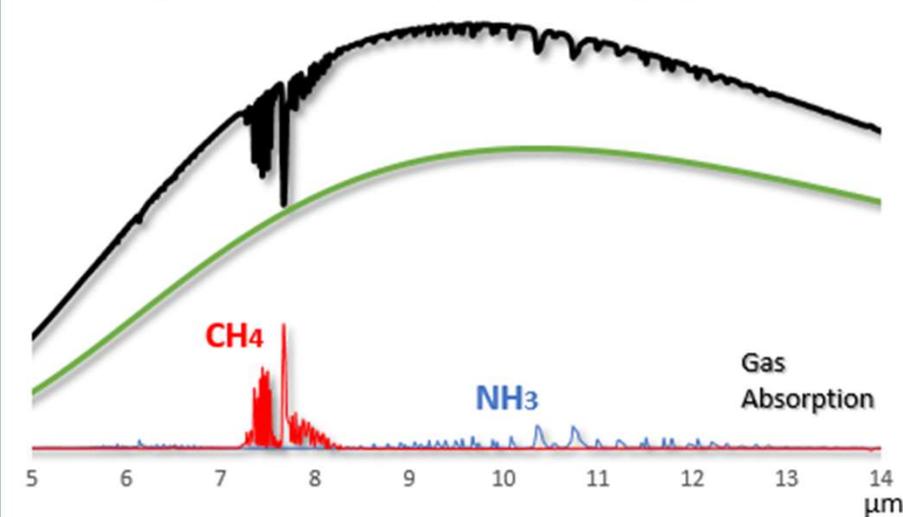
Traditional Infra-Red



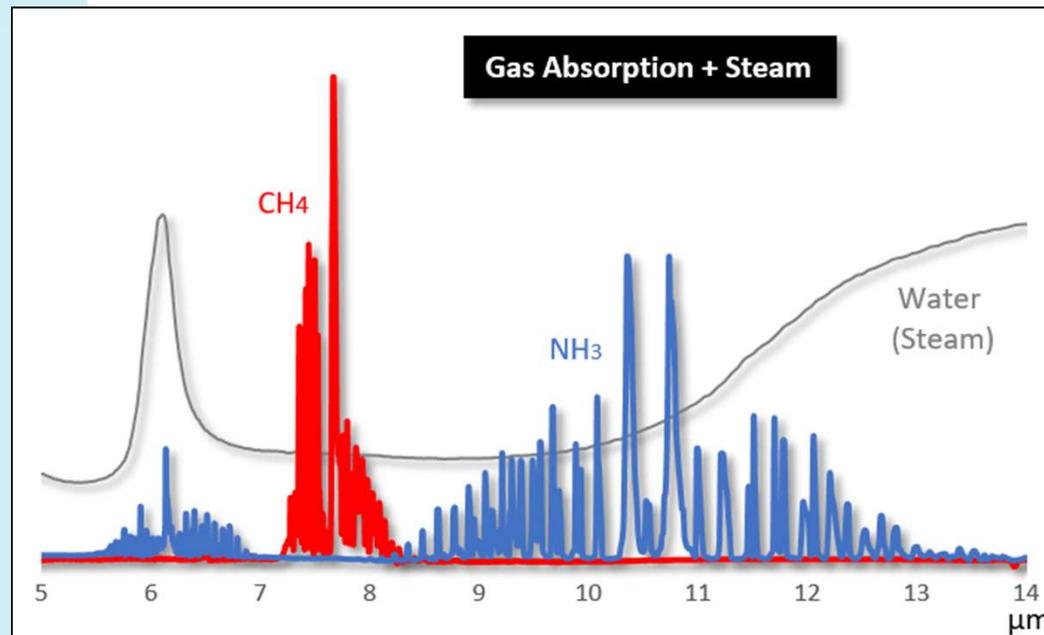
Rebellion Gas Cloud Imaging

The hyperspectral imaging technology is capable of “seeing” the spectral signature of electromagnetic radiation emitted from matter. The GCI applies this technology in the infrared electromagnetic region to detect gas leaks and differentiate them from other gases or distracting elements such as steam or atmospheric clouds greatly reducing the false alarm rate.

Blackbody radiation after it passes through gas cloud



[No false alarms on Steam]

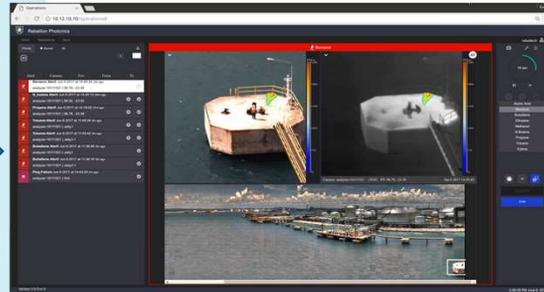


- Steam is easily distinguished from gases of interest

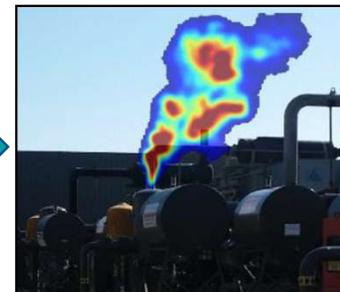
The GCI Solution



Leak Detection
Hardware



Spectra Software
Monitoring & Alarm Management



Sensing Analytics

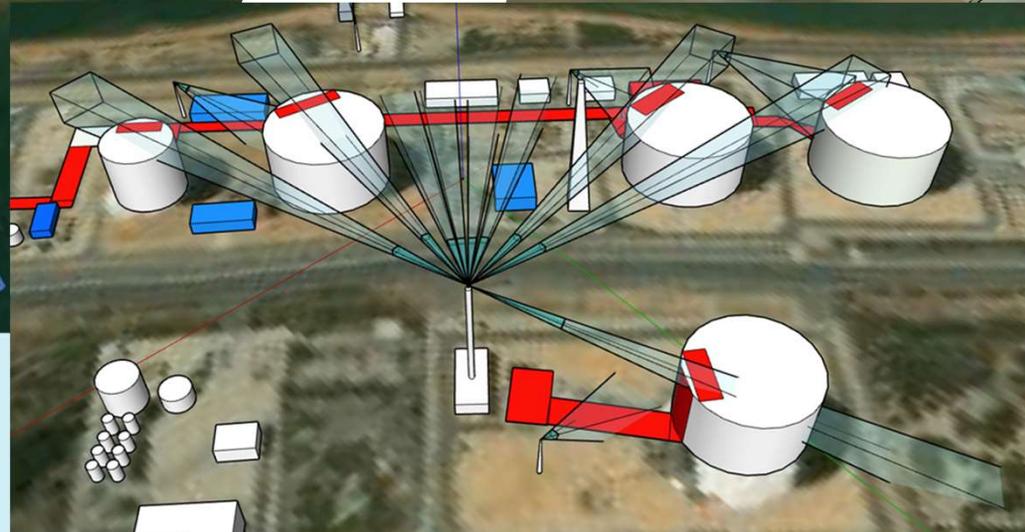
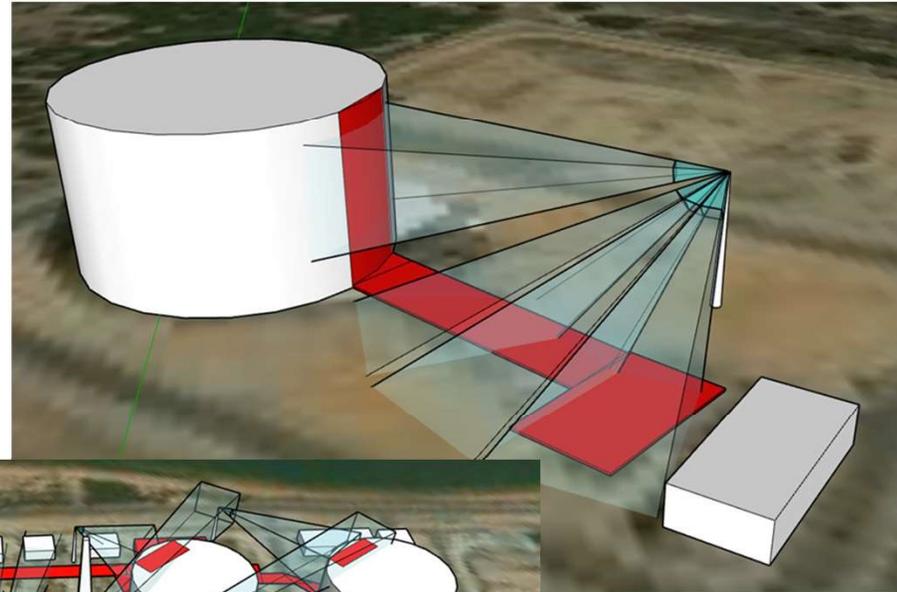
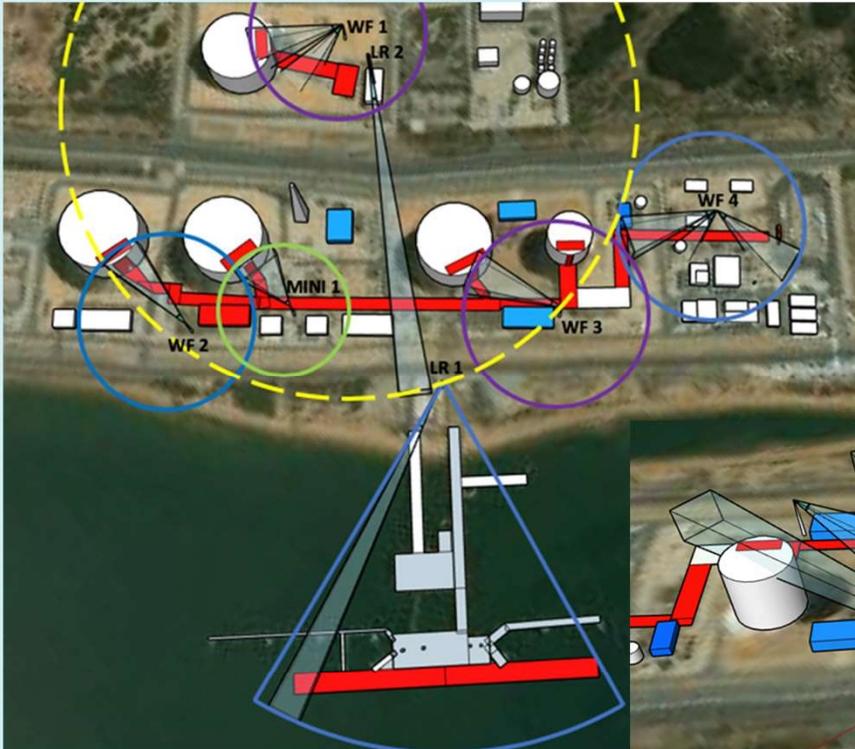


Custom Installation,
Integration & Training

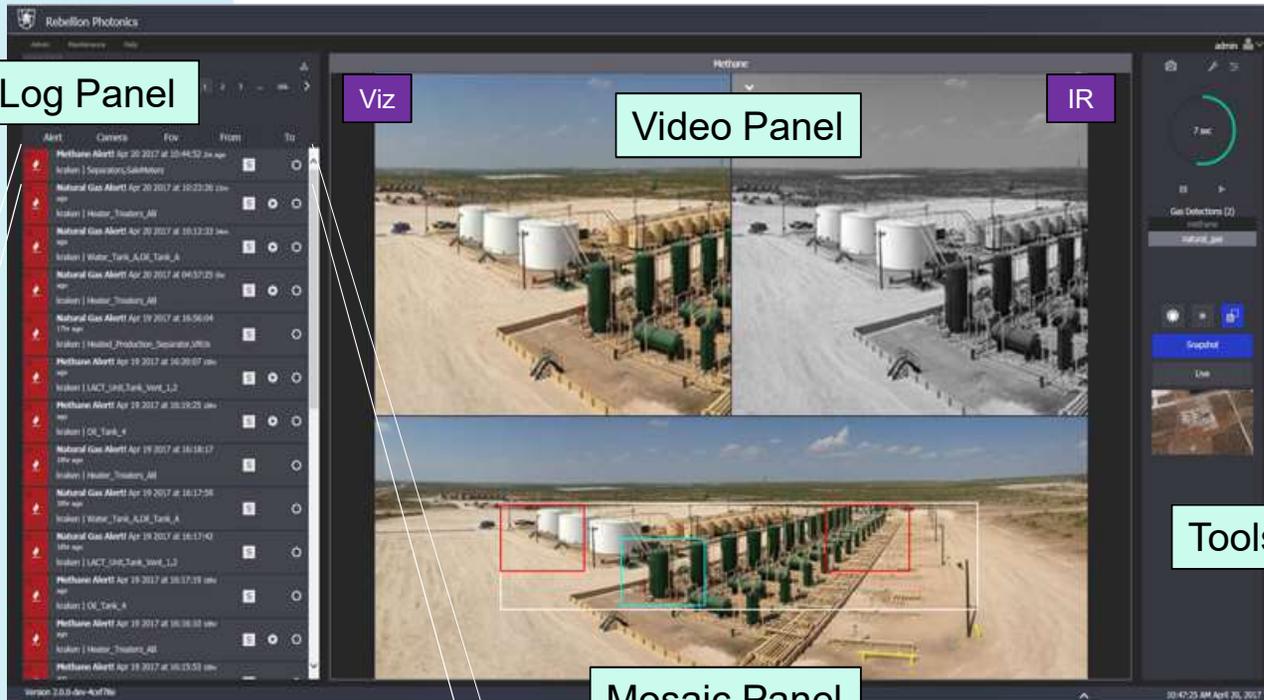
Customized GCI Solutions

- Optimized GCI Camera locations
- Customized analytics
- Software integration with DCS & SCADA

[Site Assessment – Camera Placement Modeling for LNG Plant]



Event Log Panel



Viz

Video Panel

IR

Tools Panel

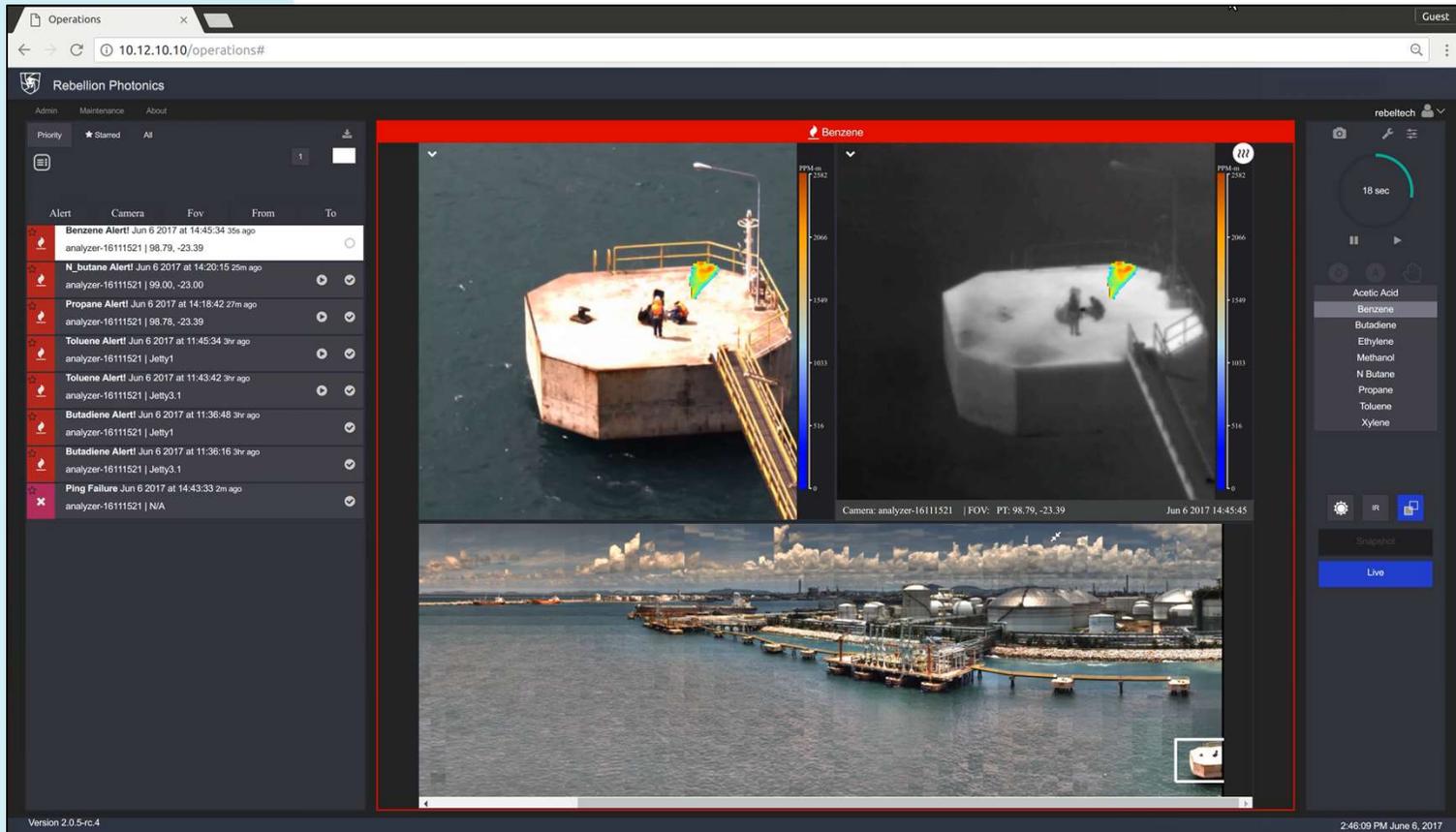
Mosaic Panel


Methane Detection. Feb 14 2017 at 16:47:52 48hr ago
 analyzer-SO1717 | 0.14, -2.71

- Manages analytics, alarms and video
- Interface with DCS or SCADA systems
- Multi-view functionality

[Benzene Release and Alarm]

Viewed in Spectra Software



The screenshot displays the Spectra Software interface for monitoring an offshore platform. The main window shows a video feed of the platform with a red overlay indicating a Benzene release. The interface includes a sidebar with an alert log, a central video feed, and a right-hand control panel.

Alert Log:

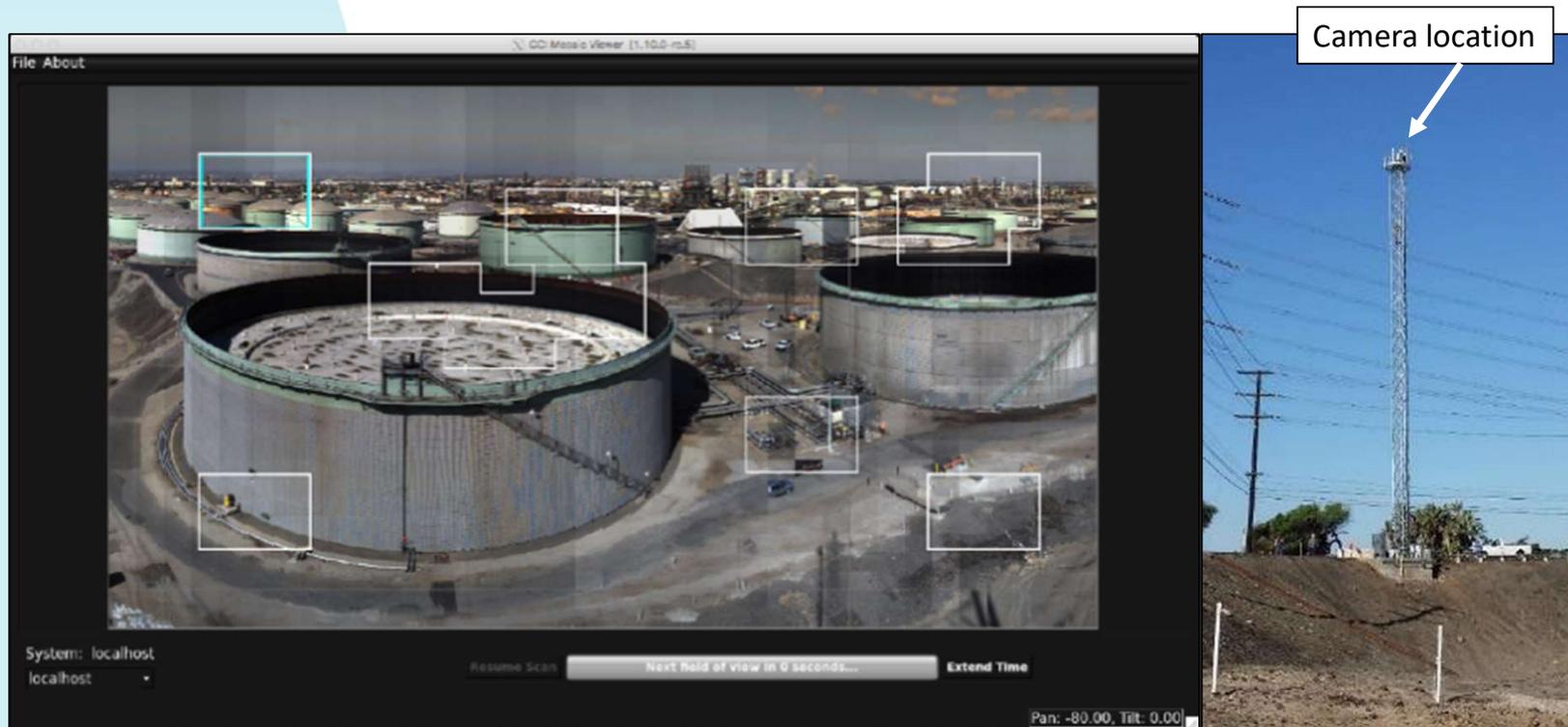
Alert	Camera	Fov	From	To
Benzene Alert! Jun 6 2017 at 14:45:34 35s ago analyzer-16111521 98.79, -23.39				
N_butane Alert! Jun 6 2017 at 14:20:15 25m ago analyzer-16111521 99.00, -23.00				
Propane Alert! Jun 6 2017 at 14:18:42 27m ago analyzer-16111521 98.78, -23.39				
Toluene Alert! Jun 6 2017 at 11:45:34 3hr ago analyzer-16111521 Jetty1				
Toluene Alert! Jun 6 2017 at 11:43:42 3hr ago analyzer-16111521 Jetty3.1				
Butadiene Alert! Jun 6 2017 at 11:36:48 3hr ago analyzer-16111521 Jetty1				
Butadiene Alert! Jun 6 2017 at 11:36:16 3hr ago analyzer-16111521 Jetty3.1				
Ping Failure Jun 6 2017 at 14:43:33 2m ago analyzer-16111521 N/A				

Video Feed: The main video feed shows a top-down view of the offshore platform. A red overlay indicates a Benzene release. The interface includes a color scale for PPM (Parts Per Million) ranging from 0 to 2562. The video feed is titled "Benzene" and shows a camera view of the platform with a red overlay indicating a Benzene release. The interface includes a color scale for PPM (Parts Per Million) ranging from 0 to 2562. The video feed is titled "Benzene" and shows a camera view of the platform with a red overlay indicating a Benzene release.

Control Panel: The right-hand control panel includes a "rebeltech" user profile, a "18 sec" timer, and a list of chemical alerts: Acetic Acid, Benzene, Butadiene, Ethylene, Methanol, N Butane, Propane, Toluene, and Xylene. There are also buttons for "Snapshot" and "Live".

Footer: The bottom of the interface shows "Version 2.0.5-rc.4" on the left and "2:46:09 PM June 6, 2017" on the right.

[Storage Tank Farm Monitoring]





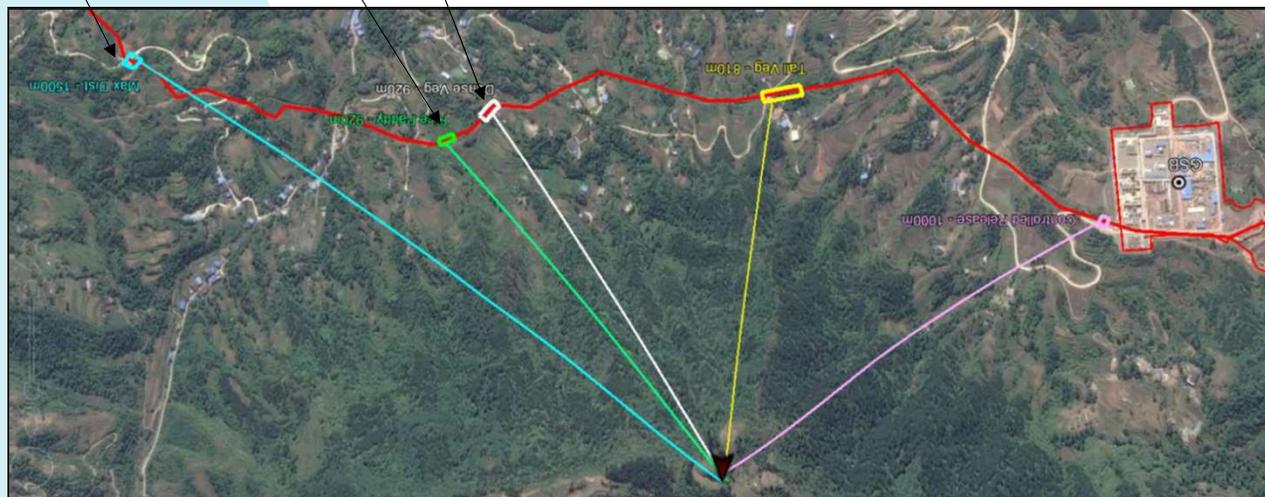
Mini GCI

Methane Detection – Pin Hole Leak



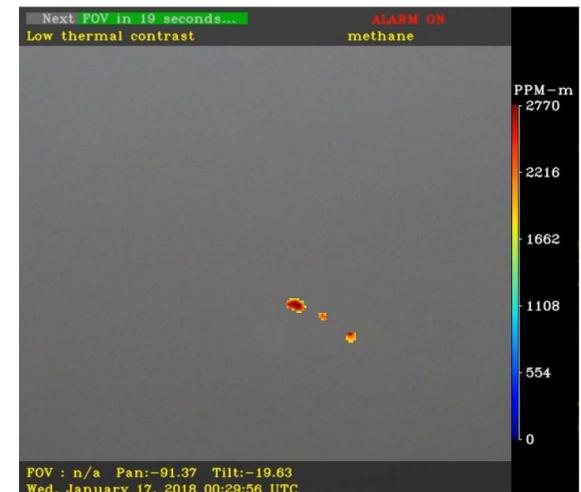
Approx. 5 km

5 km of pipeline
monitored from
one camera!



[Faraway Vision – Propylene Detection @ 1500 meters]



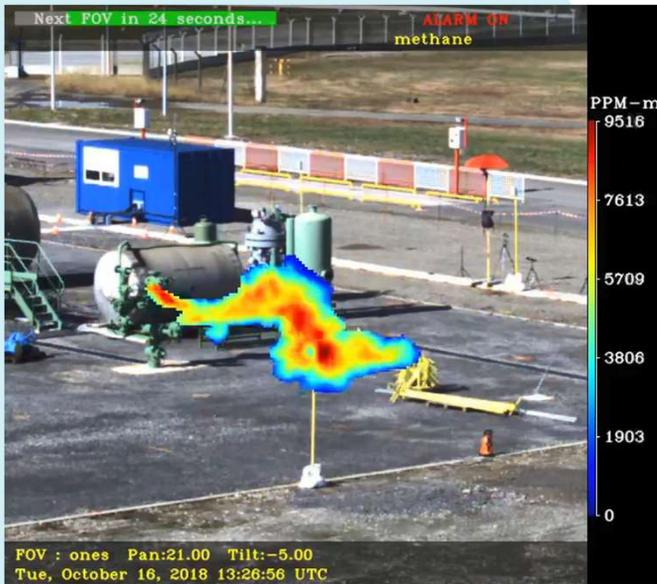


- Detected Methane Leaks in Heavy Fog

Other Weather Conditions

- Snow
- Rain
- Night
- Windy (40 MPH)

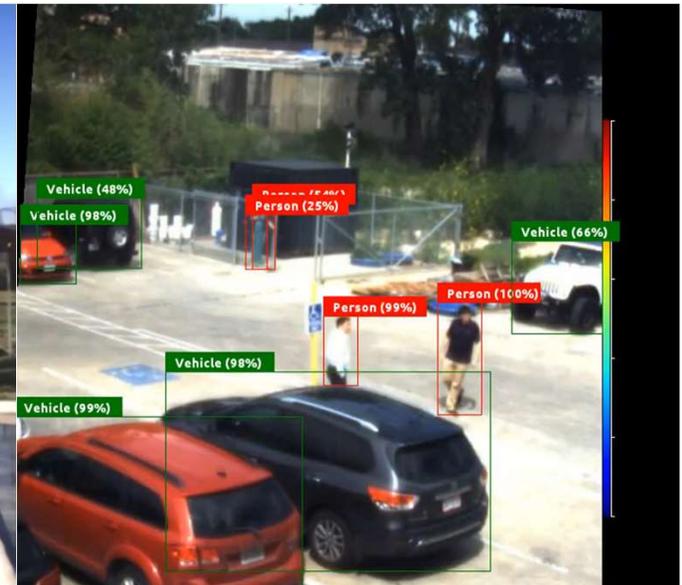
Rebellion's GCI system is capable of monitoring for Gas, Fire, and Intrusion events from a single device.



Gas Leaks:
Speciate &
Quantify



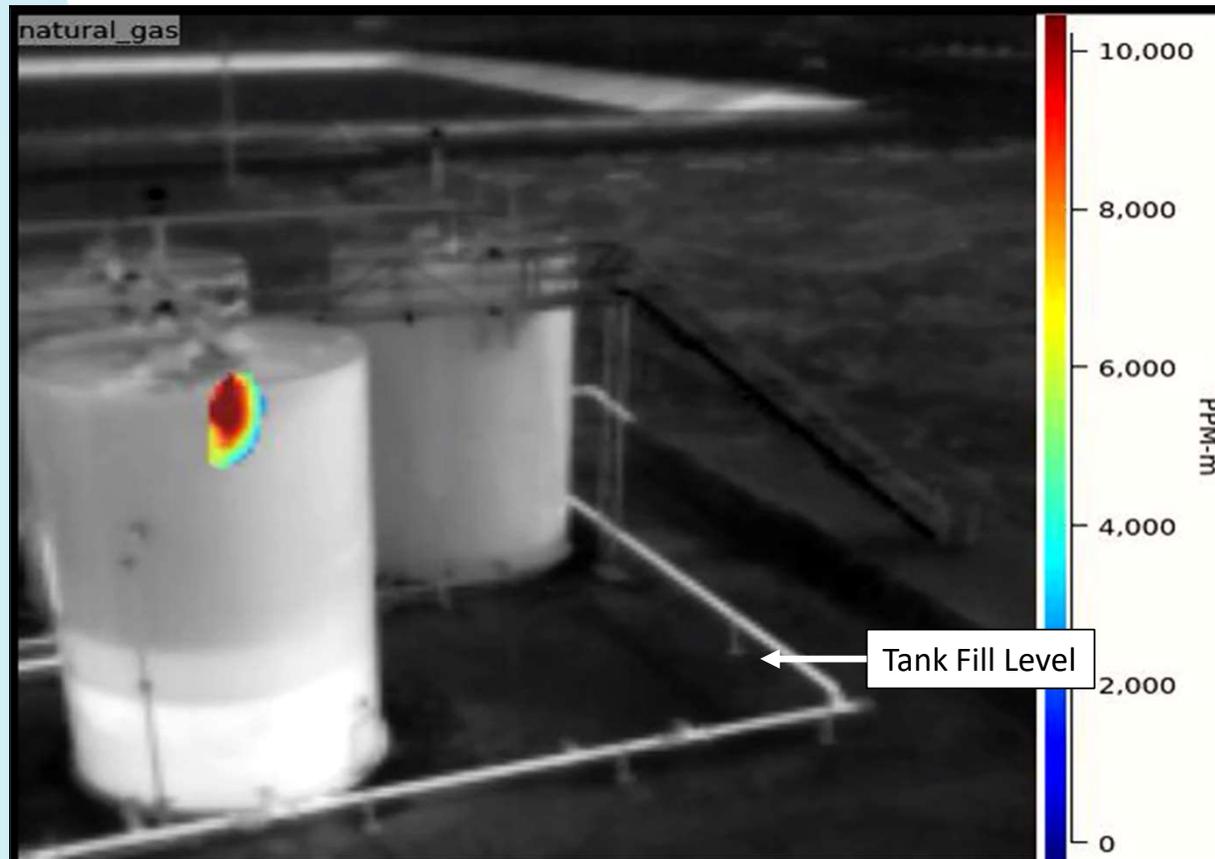
Fire*



Intrusion*

*In development. Product Launch Q4 2020

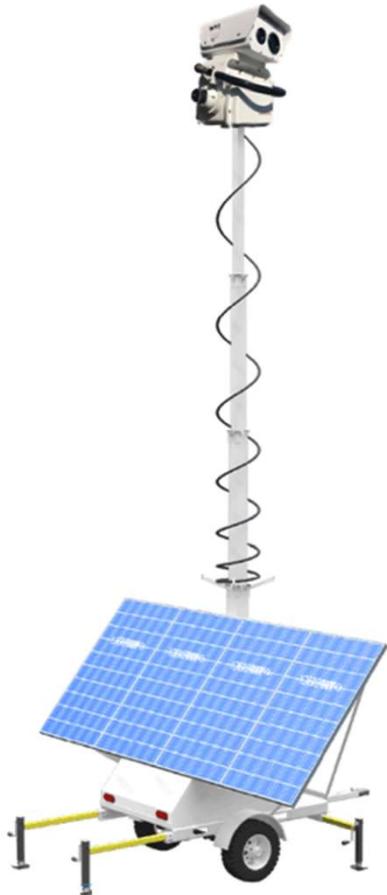
[Multiple Applications]



Tank Integrity

Rebellion Hardware Product Family

Rebellion's suite of hardware products addresses each site's monitoring challenges



SKID GCI



STANDARD GCI



MINI GCI



MINI-Ex GCI



MICRO*



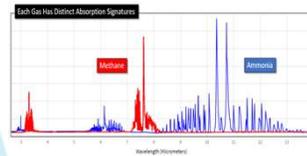
SKY GCI

Platform provider of intelligent, automated, visual monitoring solutions



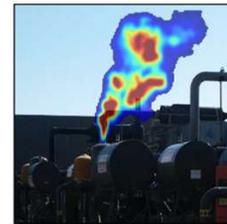
Hyperspectral
Cameras

Patented



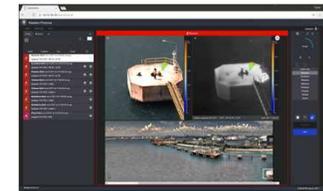
Sensing
Analytics

Developed
In-house



Detection
Identification
Quantification

Unique Capability



Alarms
Real-Time Video

Exclusive Software

Autonomous & Automated

24/7 - No humans required

Maximizing our customers' operational performance



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